CLAIMS

1. A gas heating method, wherein gas is introduced into at least one chamber having a wall coated with fissile material, and the fissile material is exposed to a neutron flux to induce fission, whereby fission fragments are released into the chamber.

2. A method according to claim 1, wherein the fission is induced in critical conditions.

3. A method according to claim 1, wherein the fissile material coating has a fissile content lower than 10 mg/cm^2, preferably in the range from 1 to 3 mg/cm^2.

4. A method according to claim 1, wherein the fissile material comprises ^{242m}Am as a fissile isotope.

5. A method according to claim 4, wherein the fissile material is in the form of a carbide.

6. A method according to claim 1, wherein the fissile material comprises ^{233}U, ^{235}U or ^{239}Pu as a fissile isotope.

7. A method according to claim 6, wherein the fissile material is in the form of a carbide.

8. A method according to claim 1, wherein said at least one chamber is located inside an enclosure surrounded by a neutron reflector.

9. A method according to claim 8, wherein the neutron reflector comprises carbon, beryllium or beryllium oxide.

10. A method according to claim 8, wherein the neutron reflector comprises a thickness of carbon material surrounding the enclosure, said thickness, in cm, being at least 50/d, where d is the density of said carbon material expressed in g/cm^3.

11. A method according to claim 8, wherein the neutron reflector has cavities for receiving removable neutron-absorbing control rods.

12. A method according to claim 8, wherein a plurality of chambers are arranged in the enclosure surrounded by the neutron reflector for receiving the heated gas.

13. A method according to claim 8, wherein said at least one chamber is in communication with an exhaust nozzle through a throat provided in the neutron reflector.

14. A method according to claim 13, wherein the enclosure has a fuel region where said at least one chamber is located, and a hot gas collecting region between the fuel region and the throat, wherein a cooling medium is circulated in a circuit having a first portion on a face of the neutron reflector adjacent to the hot gas collecting region and a second portion located in the fuel region and separated from the hot gas collecting region by a partition having an aperture in which an open end of the coated chamber wall is inserted, and wherein the coated chamber wall separates the chamber from said second portion of the cooling circuit inside the fuel region.

15. A method according to claim 14, wherein a molten metal is used as a cooling medium.

16. A method according to claim 15, wherein said molten metal comprises ^{7}Li.

17. A method according to claim 1, wherein said at least one chamber has a tubular shape.

18. A method according to claim 1, wherein the wall of said at least one chamber is made of a porous material, and wherein the gas is introduced through pores of the porous wall material.

19. A method according to claim 18, wherein said porous material is a carbon material.

20. A method according to claim 18, wherein the wall is coated with a gas-tight layer on a rear face thereof with respect to the chamber and the fissile material coating.

21. A method according to claim 20, wherein the gas-tight layer comprises titanium carbide.

22. A method according to claim 1, wherein the wall of said at least one chamber is cooled from a rear face thereof with respect to the chamber and the fissile material coating.

23. A method according to claim 22, wherein a molten metal is used as a cooling medium.

24. A method according to claim 23, wherein said molten metal comprises ^{7}Li.

Sub A1

25. A gas heating device, comprising at least one chamber for containing gas ~~having~~ a wall coated with fissile material, and means for exposing the fissile material to a

neutron flux to induce fission and the release of fission fragments into the chamber.

26. A device according to claim 25, wherein the fissile material coating and the means for exposing to a neutron flux are arranged to induce fission in critical conditions.

Sub C1

27. A device according to claim 25, wherein the fissile material coating has a fissile content lower than 10 mg/cm^2, preferably in the range from 1 to 3 mg/cm^2.

28. A device according to claim 25, wherein the fissile material comprises ^{242m}Am as a fissile isotope.

29. A device according to claim 28, wherein the fissile material is in the form of a carbide.

30. A device according to claim 25, wherein the fissile material comprises ^{233}U, ^{235}U or ^{239}Pu as a fissile isotope.

31. A device according to claim 30, wherein the fissile material is in the form of a carbide.

Sub C2

32. A device according to claim 25, further comprising a neutron reflector surrounding an enclosure in which said at least one chamber is located.

33. A device according to claim 32, wherein the neutron reflector comprises carbon, beryllium or beryllium oxide.

34. A device according to claim 32, wherein the neutron reflector comprises a thickness of carbon material surrounding the enclosure, said thickness, in cm, being at least 50/d, where d is the density of said carbon material expressed in g/cm^3.

35. A device according to claim 34, wherein said thickness of carbon material, in cm, is at least 150/d.

Sub C3

36. A device according to claim 32, wherein the neutron reflector has cavities for receiving removable neutron-absorbing control rods.

37. A device according to claim 32, wherein a plurality of chambers are arranged in the enclosure surrounded by the neutron reflector for receiving the heated gas.

38. A device according to claim 32, wherein said at least one chamber is in communication with an exhaust nozzle through a throat provided in the neutron reflector.

39. A device according to claim 38, wherein the enclosure has a fuel region where said at least one chamber is located, and a hot gas collecting region between the fuel region and the throat, wherein a cooling medium is circulated in a circuit having a first portion on a face of the neutron reflector adjacent to the hot gas collecting region and a second portion located in the fuel region and separated from the hot gas collecting region by a partition having an aperture in which an open end of the coated chamber wall is inserted, and wherein the coated chamber wall separates the chamber from said second portion of the cooling circuit inside the fuel region.

Sub A2

40. A device according to claim 39, wherein a molten metal is used as a cooling medium.

41. A device according to claim 40, wherein said molten metal comprises ^{7}Li.

42. A device according to claim 25, wherein said at least one chamber has a tubular shape.

43. A device according to claim 25, wherein the wall of said at least one chamber is made of a porous material, and further comprising means for introducing the gas into the chamber through pores of the porous wall material.

44. A device according to claim 43, wherein said porous material is a carbon material.

Sub A3

45. A device according to claim 43, wherein the wall is a coated with a gas-tight layer on a rear face thereof with respect to the chamber and the fissile material coating.

46. A device according to claim 25, wherein the wall of said at least one chamber is cooled from a rear face thereof with respect to the chamber and the fissile material coating.

Sub A4

47. A device according to claim 46, wherein a molten metal is used as a cooling medium.

Sub C4

48. A device according to claim 47, wherein said molten metal comprises ^{7}Li.

Sub A5

49. A space engine comprising a gas heating device according and means for expelling the heated gas into space to generate thrust, wherein the gas heating device comprises at least one chamber for containing gas having a wall coated with fissile material, and means for exposing the fissile material to a neutron flux to induce fission and the release of fission fragments into the chamber.

50. A space engine according to claim 49, wherein the heated gas comprises hydrogen.

51. A space engine according to claim 49, wherein the heated gas comprises at least one component selected from the group consisting of carbon dioxide, helium and argon.

Sub B6

52. A space engine according to claim 49, wherein the fissile material coating and the means for exposing to a neutron flux are arranged to induce fission in critical conditions.

Sub C5

53. A space engine according to claim 49, wherein the fissile material coating has a fissile content lower than 10 mg/cm^2, preferably in the range from 1 to 3 mg/cm^2.

54. A space engine according to claim 49, wherein the fissile material comprises ^{242m}Am as a fissile isotope.

55. A space engine according to claim 54, wherein the fissile material is in the form of a carbide.

56. A space engine according to claim 49, wherein the fissile material comprises ^{233}U, ^{235}U or ^{239}Pu as a fissile isotope.

57. A space engine according to claim 56, wherein the fissile material is in the form of a carbide.

Sub C6

58. A space engine according to claim 49, further comprising a neutron reflector surrounding an enclosure in which said at least one chamber is located.

59. A space engine according to claim 58, wherein the neutron reflector comprises carbon, beryllium or beryllium oxide.

60. A space engine according to claim 58, wherein the neutron reflector comprises a thickness of carbon material

surrounding the enclosure, said thickness, in cm, being at least 50/d, where d is the density of said carbon material expressed in g/cm^3.

61. A space engine according to claim 58, wherein the neutron reflector has cavities for receiving removable neutron-absorbing control rods.

62. A space engine according to claim 58, wherein a plurality of chambers are arranged in the enclosure surrounded by the neutron reflector for receiving the heated gas.

63. A space engine according to claim 58, wherein the means for expelling the heated gas comprise an exhaust nozzle, and said at least one chamber is in communication with said exhaust nozzle through a throat provided in the neutron reflector.

64. A space engine according to claim 63, wherein the enclosure has a fuel region where said at least one chamber is located, and a hot gas collecting region between the fuel region and the throat, wherein a cooling medium is circulated in a circuit having a first portion on a face of the neutron reflector adjacent to the hot gas collecting region and a second portion located in the fuel region and separated from the hot gas collecting region by a partition having an aperture in which an open end of the coated chamber wall is inserted, and wherein the coated chamber wall separates the chamber from said second portion of the cooling circuit inside the fuel region.

Sub A1

65. A space engine according to claim 64, wherein a molten metal is used as a cooling medium.

66. A space engine according to claim 65, wherein said molten metal comprises ^{7}Li.

67. A space engine according to claim 49, wherein said at least one chamber has a tubular shape.

68. A space engine according to claim 49, wherein the wall of said at least one chamber is made of a porous material, and further comprising means for introducing the gas into the chamber through pores of the porous wall material.

69. A space engine according to claim 68, wherein said porous material is a carbon material.

Sub A7

70. A space engine according to claim 68, wherein the wall is coated with a gas-tight layer on a rear face thereof with respect to the chamber and the fissile material coating.

71. A space engine according to claim 49, wherein the wall of said at least one chamber is cooled from a rear face thereof with respect to the chamber and the fissile material coating.

Sub A8

72. A space engine according to claim 71, wherein a molten metal is used as a cooling medium.

Sub C7

73. A space engine according to claim 72, wherein said molten metal comprises ^{7}Li.